Implementing 3-D ultrasound elastography in an automated breast volume scanner to improve specificity for breast cancer detection

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Introduction

Automated breast volume scanner (ABVS) [1]

- Designed for screening with ultrasound (US)
- Creates stacks of continious US images covering the entire breast
- Operator-independent
- Suitable for dense breasts

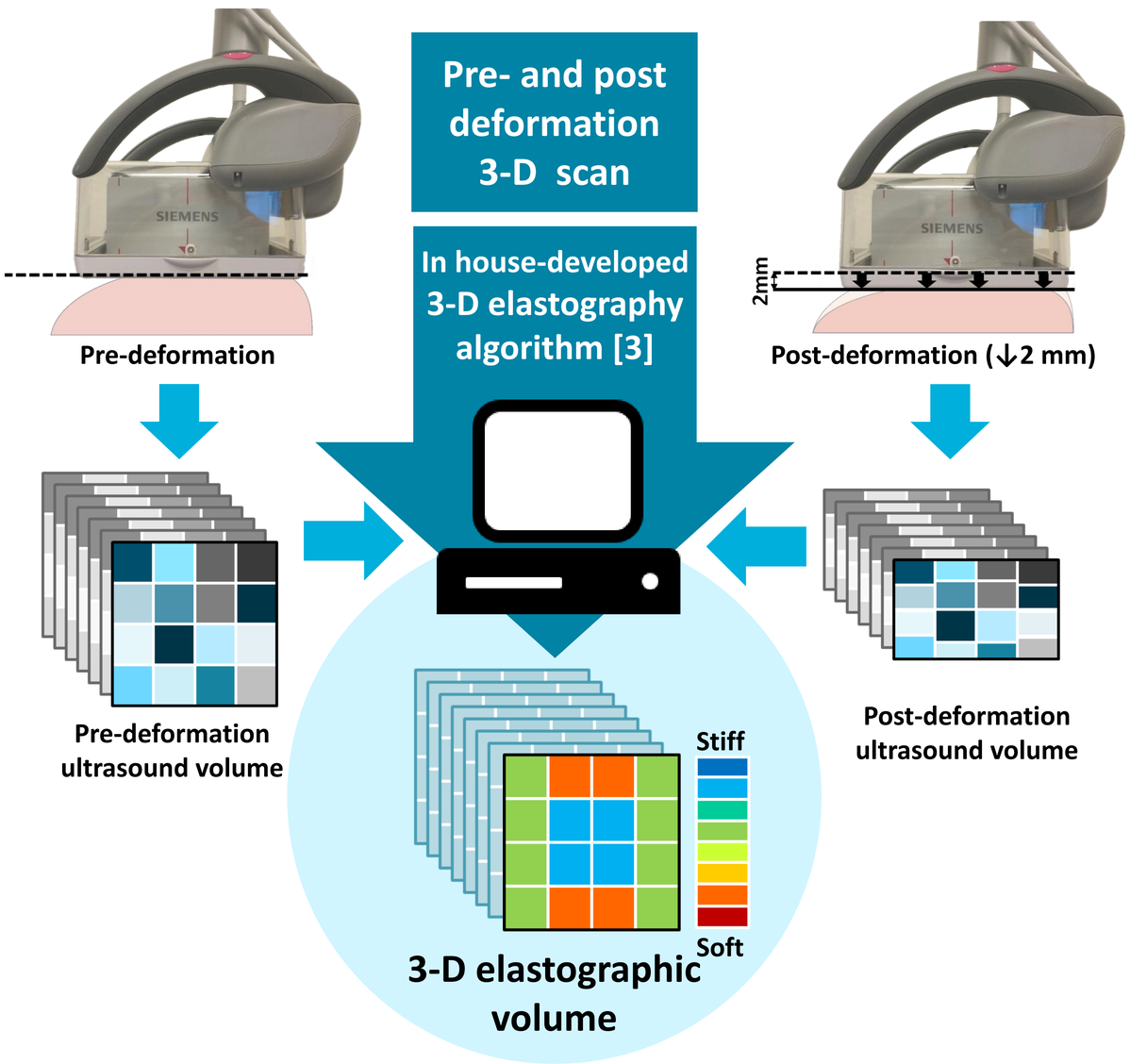
Ultrasound elastography

- Imaging method based on lesion stiffness (malignant lesions are stiffer than healthy breast tissue)
- Can be used as add-on to gray-scale ultrasound to improve specificity for cancer detection [2]
- So far not available for ABVS

Objective
Development of **3-D ultrasound elastography for ABVS** to improve breast lesion classification

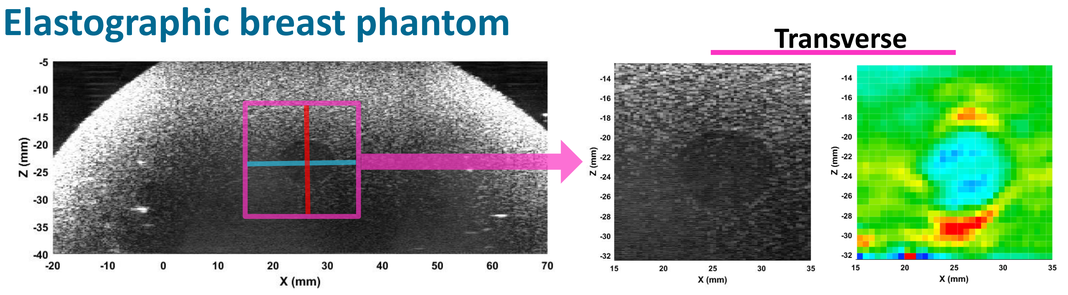
Material and Methods

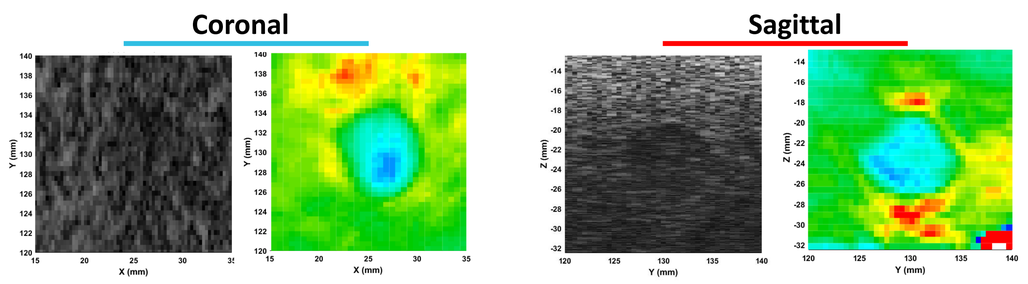
- Two ABVS scans of the breast at different rates of deformation
- Analysis of raw ultrasound data to estimate the tissue stiffness
- Validation in breast elastography phantom
- Feasibility evaluation with initial patient studies



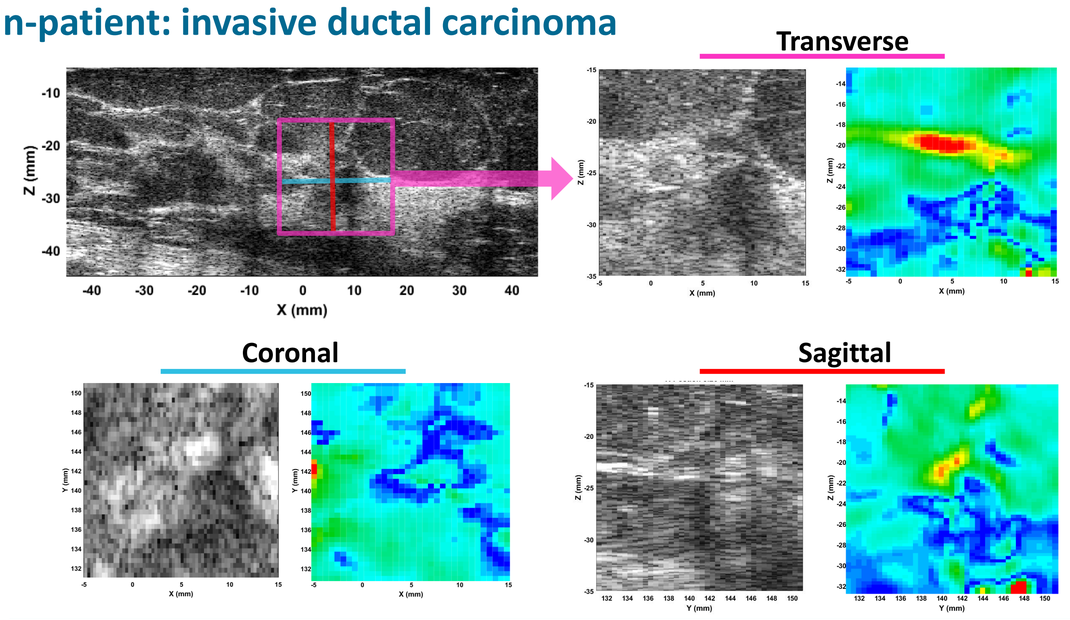
Results

Elastographic breast phantom





In-patient: invasive ductal carcinoma



Discussion

3-D ultrasound elastography is feasible for ABVS

- Verified by phantom and initial *in-patient* results
- Expected to improve specificity of ABVS [2]
- Operator-independent elastography
- Relatively easy to implement in clinical routine
- Allows simultaneous reading of elastographs and B-mode

Future steps:

- Automated acquisition of pre- and post-deformation scans
- Patient study to determine clinical value
- Reduce breathing artifacts by ultrafast ultrasound imaging
  - In house-developed ABVS prototype demonstrates that this might be possible [3]

Conclusion
An operator-independent **3-D breast ultrasound elastography** method was brought from bench to bedside, in order to improve specificity of the ABVS system.

[1] Acuson S2000 ABVS, Siemens Healthcare, Issaquah, WA [2] Barr RG, J Ultrasound Med, 2012: 31(5): 773-83. [3] Hendriks GAGM et al., Phys Med Biol. 2016: 61(7):2665-79

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